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ABSTRACT

In a review of over 25 empirical investigations of effects of communicating behavioral objectives to students, several trends were apparent. Advance knowledge of behavioral objectives led to improved posttest performance in five of ten studies and to improved retention in two of three instances. Only two of seven studies found an interaction between knowledge of objectives and type of learning: in one case knowledge acquisition but not comprehension was facilitated, while in the other knowledge of objectives interfered on a problem-solving task, but not on a discrimination task. A third group of studies reported interactions between availability of objectives and reasoning ability, personality characteristics, and state anxiety. Finally, when coupled with complete learner control of the course, knowledge of objectives decreased learning time. (Author/RH)

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TECH MEMO

THE EFFECTS OF BEHAVIORAL OBJECTIVES ON LEARNING: A REVIEW OF EMPIRICAL STUDIES

Philippe C. Duchastel and Paul F. Merrill

Tech Memo No. 45
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A third group of studies sought interactions between the availability of objectives and learner characteristics. Interactions were reported with reasoning ability, personality characteristics, and state anxiety.

Finally, a fourth group of studies investigated the effect of the availability of objectives on the time required to complete the learning task. Coupled with learner control, objectives reduced learning time, but alone, objectives either had no effect or increased learning time.

In the concluding section of the review, the context of the issue within instructional theory is discussed, as well as the rationales which predict a facilitative effect on learning. Problems involved in research on objectives are also discussed and a direction for future research is suggested.

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The concept of the clearly stated and specific instructional objective is not a new one to the academ c community. Curriculum specialists were already advocating the need for specificity of objectives some 30 years ago (see Popham, 1969a). However, with the appearance of Mager's classic little book, the educational community has had to come to grips with both the feasibility of using behavioral objectives and the value of such objectives to teaching and learning. Individual educators as well as organizations from the school level to the state level have taken sides on the issue And one has only to glance through the more teacher-oriented journals to find a constant flow of articles dealing with the topic of behavioral objectives. While most of the authors are strong proponents of the behavioral objective movement, a small group of educators has resisted this surge and put to question the value of the process (e.g., Atkin, 1969; Eisner, 1967; Ebel, 1970).

A few investigators have turned to research in an attempt to base perceptions of the issue on empirical grounds rather than on purely logical/rhetorical grounds. As Eisner (1967) has pointed out, whether or not behavioral objectives are of value or not in curriculum construction, teaching, and learning is really an empirical question.

And research continuing to increasing rate: of the 28 studies reported in this review, 18 appeared since 1970.

Role of Behavioral Objectives

Various rationales can be expressed for specifying behavioral objectives in education, and numerous authors have advanced such rationales (e.g., Popham, 1969b; Lindvall, 1964). However, for the purpose of clarity, it seems appropriate to view behavioral objectives as serving three main instructional functions: (a) direction for teaching and curriculum development; (b) guidance in evaluation; and (c) facilitation of learning

As a means for improving teaching, some research evidence has come to our attention with regard to the use of behavioral objectives. A few studies (McNeil, 1967; Baker, 1969; Jenkins & Deno, 1971; Piatt, 1969; Bryant, 1970; Schneiderwent, 1970) have been reported but are not reviewed here. Empirical research in this area would seem to be open to greater difficulties than it would in the area of learning. However, greater practical benefits perhaps may also be derived from this approach.

As providing guidance for evaluation, behavioral objectives seem implicitly valuable (Briggs, 1970). Although criterion-referenced evaluation may not be amenable to classical statistical techniques (Popham & Husek, 1969), this should be a minimal factor determining its usefulness. Two studies (Briggs, Stoker, & Scanlon, 1971; Griffin, 1971) were reported in the area of evaluation, but will not be reviewed in this paper.

The third function of behavioral objectives, i.e., as an aid to learning, is the focus of this review. The issue, in general terms, can be stated as follows: Does communicating behavioral objectives to students have a facilitative effect on their learning? As will be seen, no simple answer can be provided. A number of studies have shown facilitative effects. However, an equal number of studies have failed to demonstrate any significant differences. An attempt will be made, therefore, to consider the contributing factors which result in this situation.

We shall first consider the general nature of the variables involved in the studies comprising this review. Then we will follow detailed presentation of the investigations themselves. We have included as much detail as is practical so that the reader may distinguish among results according to the variables of interest.

Behavioral Objectives and Learning

The first variable to consider is the specificity of the objectives. Many of the studies reviewed simply report a distinction between providing no objectives and providing behavioral objectives. Others go further and differentiate between behavioral objectives, general objectives, and no objectives. Still others are not as precise and simply refer to instructional objectives or educational objectives. Some studies give an indication of the criteria by which they define the objectives employed or even give examples of their objectives, while others give no such indication.

For the purpose of this review, we have believed it advantageous to distinguish simply between behavioral objectives and general objectives. While this approach may seem oversimplified, more precise definitions could immensely confound the issue and hamper any generalizations across studies. Generally, however, behavioral objectives have been stated in behavioral terms whereas general objectives are of a more inclusive and broad nature. In those studies where the objectives employed seemed to be at odds with these definitions, we have briefly mentioned it in the review.

The second variable of importance which has been investigated in various studies is the type of learning involved in the learning task. This was most often broken down into two categories: (a) knowledge, usually considered as factual information; and (b) comprehension, dealing mainly with the learning of concepts and principles. Here also, operational definitions of this variable are often lacking. In one study, generalization as well as relevant versus incidental learning were investigated. In another study, both cognitive and affective factors were investigated.

The third group of variables investigated consisted of student characteristics. A number of researchers have looked at student ability, sometimes categorized simply as high, medium, or low ability. Other factors were also investigated, including sex, personality, and socio-economic status.

While dependent measures were numerous, the usual ones employed were learning (as measured on an immediate posttest) and retention (often a test administered one to several weeks later). Other dependent variables

investigated include the time necessary for the subject to reach mastery of the task, and student attitude. Incidental evidence is also available on the use of the behavioral objectives by students in practical situations.

Review of Studies

The studies reviewed in this paper have been grouped into four categories. The first category comprises those investigations which addressed the general issue of the effect of objectives on learning. The studies in the second category further investigated these effects according to the type of learning involved. The third category deals with studies involving learner characteristics. And finally, because of their special nature, those studies utilizing time to criterion as their major dependent variable were grouped in a fourth category.

General

This first category involves those studies which have merely investigated the hypothesis that students provided with behavioral objectives will achieve more than students not provided with objectives. There are ten studies included in this category.

Doty (1968) investigated the effect of prior knowledge of educational objectives along with the effect of practice on performance in an industrial arts area. The treatments were given to 190 seventh-grade students sampled from seven public schools. The instructional unit was a written text on reading and calculating the value and tolerance of carbon axial resistors. The treatments were administered in a 55-minute period.

A posttest measure of performance indicated a significant superiority for those students receiving the three objectives. No interaction with practice existed

Blaney and McKie (1969) investigated the effect of providing behavioral objectives to a group of conference attendees. The two-day conference for adult educators dealt with new management techniques in education. Sixty volunteers were divided into three groups: the first group was provided with the objectives of the conference in behavioral form; the second group was given a general introduction to the conference, which amounted to little more than what had been sent to attendees earlier through the mail; and the third group was merely administered a pretest in order to determine the amount of learning which would take place during the conference. Each of these pre-conference treatments was administered just prior to the beginning of the program. It was hypothesized that the group receiving the objectives and the group receiving the pretest would do better on an immediate posttest than the group receiving only the verbal introduction. It was also hypothesized that there would be no significant difference between the objectives group and the pretest group. The first hypothesis, planned as an a priori one-tailed test, resulted in a significant difference at the .05 level. No other significant differences were found between groups although all participants in the pretest group gained on the posttest, some of them substantially. In conclusion, while there was a significant difference between the objectives group and the verbal introduction group, there was no significant difference

between the objectives group and the pretest group nor between the verbal introduction group and the pretest group.

Tiemann (1968) investigated the effects of providing behavioral objectives to students along with the effects of two types of televised instruction. The setting was a college economics course. Students received televised instruction which had been revised using either intuitive, conventional procedures or procedures evolving from a programming approach which included formative evaluation. Students also attended weekly seminars. With each of these treatments, students received either general objectives or specific objectives subsumed under the appropriate general objectives. It should be noted, however, that most of the behavioral objectives are very close to summary statements of the form "Recognize that...(rule), Indicate that... (rule)." The general objectives, on the other hand, were similar to the following: "Understand the relationship between...." A criterion-referenced posttest was administered as a midterm examination after the 4-week treatment period (which consisted of eight videotaped lectures and a weekly seminar). A retention test, included as an integral part of the final examination, was administered at the end of the course. Pretest scores, obtained during the first week, were used as covariables in both analyses. Results from the posttest analysis revealed a significant main effect for type of instruction, but none for type of objective. The retention test, on the other hand, resulted in a significant objective effect, with the behavioral objectives group achieving above the general objectives group. More favorable attitude, as measured by a course evaluation questionnaire, was also associated with the provision of behavioral objectives. The lack of student questions referenced to the objectives during the seminar periods led the author to the assumption that the importance of the

objectives was assessed by the students only after the midterm examination, which was directly referenced to the objectives. This would explain the shift in main effects.

Dalis (1970) investigated the effect of the specificity of objectives on achievement as well as the degree to which the objectives were understood by the students. Five health and safety classes taught by the same teacher participated in the study. The 133 tenth-grade students received one of three treatments: (a) precisely stated instructional objectives; (b) vaguely stated objectives; or (c) short paragraphs of health information. The learning task was a 3-week unit on growth and development for which sixteen precise and vague instructional objectives were written. The vague objectives were similar to the precise objectives except that both the content and behavior dimensions were general. Achievement was measured by a sixty-eight item criterion test administered at the conclusion of the unit. Furthermore, for each objective, one multiple-choice test item was developed to assess the students' understanding of the objective. Achievement results indicated that the precisely-stated objective group performed significantly superior to the other two groups, which in turn did not differ significantly from one another. Information was also collected concerning the amount of study time spent outside of class each day, but no significant differences between groups existed.

Boardman (1970) investigated the use of behavioral objectives in remedial chemistry. Two factors were investigated within four groups of students: advance knowledge of behavioral objectives and attendance to a lecture/laboratory session. No significant differences on achievement were observed between groups. However, with the groups not attending

lecture and laboratory, performance was positively related to the students' understanding of the objectives, as measured on a student questionnaire.

Bishop (1969) investigated the effect of prior exposure to performance objectives with ninth grade students of vocational agriculture. Half of his 88 subjects received behavioral objectives for either one of two instructional units. Three covariates were employed in the analysis: pretest score, IQ, and cumulative grade point average. No significant differences were found on either an immediate test of recall of knowledge or a 30-day retention test of knowledge.

Lawrence (1970) investigated the effects on performance of a factual information organizer, a list of behavioral objectives, and a pretest. Her list of objectives, however, was more a presentation of rules than of classical behavioral objectives. A typical objective was "The student should know that pain is an individualized symptom; it is a subjective experience." Subgroups of her 216 subjects were given either one treatment or treatment combinations before an instructional unit on nursing care. Performance was measured by a 50-item test which also served as the pre-test treatment. The presence or absence of a 2-hour lecture was also a variable. The behavioral objectives treatment was significantly superior to a control condition, either alone or in combination with the pre-test treatment. The behavioral objectives treatment was also significantly superior to the other treatments. No interaction existed with the availability of the lecture.

Weinberg (1970) studied the effect of behavioral objectives on bowling knowledge and skill. Students enrolled in four classes received either no objectives, general objectives, behaviorally stated objectives

describing terminal behaviors only, or behaviorally stated objectives describing both intermediate steps and terminal behaviors. The tests developed to measure learning during the 10-week instructional period covered ability to bowl, form, knowledge of game strategy, rules, scoring, and the mechanics of bowling. No significant differences were obtained between treatment groups on these tests.

Smith (1967) investigated the effect of providing slow learners with behavioral objectives This study also included an analysis of whether presenting the instructional unit in its entirety differed from presenting it lesson by lesson A sample of 162 students from 10 eighth grade classes was selected These students were selected as being slow learners. The unit of instruction was a semi-programmed unit in elementary probability Half of the classes received the unit in its entirety while the other half received it lesson by lesson. In each of the ten classes, half of the students received instruction concerning the expected goal The other half of the students received no such instruction. The posttest, which contained an item for each objective, was administered upon completion of the unit Results failed to reveal any significant differences between either of the groups. It was concluded that the performance of the slow learners was not affected by the presence of instructions concerning expected outcomes.

A study by Engel (1968) sought to determine the effect of stated behavioral objectives on achievement in a unit of instruction in mathematics. The subjects selected were 48 elementary education majors. One-half of the students received a cover sheet stating the objectives of the unit in terms of learner performance. The other half did not receive this cover sheet. The 12 lessons included in the partially programmed unit

of instruction were administered during eight consecutive class days. On the ninth day, a performance test was given to the students. The same test was also readministered three weeks later. Results revealed a significant difference between the two groups on both the posttest and the retention test, in favor of the behavioral objectives group.

This first group of studies is difficult to summarize because of the lack of consistent results across investigations. On immediate retention, measured by a posttest, five studies reported a significant effect due to the availability of behavioral objectives, but five further studies reported no such effect. On measures of delayed retention, two investigations found objectives to enhance performance and one did not find this facilitative effect. In summary, the availability of objectives was found to facilitate learning in certain instances, although the generalizability of these instances is not easily determined.

Type of Learning

The studies included in this second group have addressed the issue of whether objectives may facilitate performance for one type of learning but not for another. They have sought interactions between type of learning and availability of objectives. Most of these studies have categorized learning as knowledge and comprehension, where knowledge is understood to be the learning of facts and comprehension to be the learning of principles. Precise definitions, however, are often lacking. There are seven studies grouped in this category.

Oswald and Fletcher (1970) studied the effects of varying levels of specificity of objectives which dealt with either knowledge or comprehension outcomes. The subjects were 619 eleventh grade social science students. Each student received an independent study packet which contained

objectives, one of two sets of reading materials, and a forty-item test. Half the test items were measures of knowledge and half were measures of comprehension. The students randomly received one of five treatments: four groups received either specific objectives or general objectives which were in turn either knowledge objectives or comprehension objectives; the fifth group received a placebo statement which was considered a nonobjective. The specific objectives were reported to meet the criterion of Mager (1962) and the general objectives, the criteria of Tyler (1950). After 25 minutes of reading time, the students were requested to take the test. One week later, the same test was readministered to the students. No significant differences were found between any of the groups on either the posttest or the retention test

Jenkins and Deno (1971) performed an experiment to determine the effects of knowledge of objectives on the part of the teacher and on the part of the learner. Objectives were either general or behavioral and given to either teachers only, teachers and students, or students only. As the authors point out however, this last treatment is confounded with the manner in which content was presented. Indeed, for this group, teachers were eliminated and the subjects received self-instructional materials, along with the objectives. A control group received no instruction whatsoever, but took the criterion examination. Subjects were 112 college students and the materials were taken from an instructional unit on social science methodology developed by Baker (1969). No main effects nor interaction effects were statistically significant. However, while the mean score for the experimental groups significantly exceeded that for the control group, the gains from instruction were very slight. Therefore, results of this study should be interpreted with caution.

Papay (1971) investigated the effects of types, location, and distribution of orienting instructions. These included behavioral objectives, questions, and advanced organizers, which were either presented before or after the textual material and either massed or distributed. The instructional unit was a 3500-word passage dealing with the endocrinology of pubescence which was developed by Ausubel and Fitzgerald (1962). Subjects were 229 introductory psychology students who were assigned to 12 treatment and 4 control groups. A pretest and one-week retention test were administered. Each consisted of 28 multiple-choice items, half of which assessed factual information and the other half comprehension. Main effect analysis revealed that, for the factual information items on the posttest, all three groups which received orienting instructions were statistically superior to the control groups; while none of the three was significantly better than the other two. For the comprehension items on the posttest, only the advanced organizer groups were superior to the control; moreover, these groups were significantly superior to both the behavioral objectives groups and the questions groups. For factual information, none of the treatments was superior to the control on the retention test, nor were the treatments different among themselves. However, for comprehension on the retention test, only the groups that received the questions were significantly superior to the control groups; they were also superior to the behavioral objectives group. With regard to location, all three treatments were superior to the controls at prelocation for factual information. For comprehension, only the advanced organizer was superior. At post location, the questions were the only effective orienting stimuli. With regard to distribution, interactions

were found for the advanced organizers and the questions. As an overall summary of this study, it could be said that the behavioral objectives, while effective at pre-location for learning of factual information as measured by the posttest, were found generally to produce the least effect of the three treatments on the facilitation of learning.

Olson (1971) investigated the effect of providing behavioral objectives to students as well as knowledge of results and assignment of grades on quizzes. One hundred and one college students went through four units of textual materials on interior design. Half of these students received behaviorally-stated objectives, whereas the other half did not receive them. Within each of these conditions, subjects were assigned to subgroups which were provided with either knowledge of results on the unit quizzes or no such knowledge, and either grades for quiz performance or no grades. While 15 behavioral objectives were developed for each unit, only 10 of these were given to the students in the behavioral objectives groups. Dependent measures consisted of unit quizzes and a final test administered 5 days after the last unit and again 2 weeks later to evaluate retention. The unit quizzes covered the 10 behavioral objectives presented to certain students. The final test consisted of three types of items: (a) a sample of items covering the behavioral objectives presented; (b) items covering the behavioral objectives not presented; and (c) items which called for generalization of principles or concepts. Results failed to support the hypothesized facilitative effect due to behavioral objectives.

Yelon and Schmidt (1971) investigated the effect of objectives and instructions on the learning of a complex cognitive task. A second variable involved in the study was the administration of a pre-criterion

test. It was hypothesized that this test would provide some indication to the student of what he was expected to learn. The situation was a laboratory one in which treatments were administered to each subject individually. The task was to master a puzzle called "Think-A-Dot" in which the subject must be able to predict the changes that will occur in a pattern of dots which is altered in a mechanical toy when a marble is set in motion. Seventy-two graduate students were divided into four treatment groups. Subjects in the first group were simply told to play the game. The second group was given an explicit objective detailing the terminal behaviors to be measured at the end of the 20-minute session. The third group was provided with instructions on how the toy worked. These included the principles by which it operated. The fourth group received both the behavioral objective and the instructions. Half of the subjects in each group were further administered a pre-criterion test at the middle of the session, which was a shortened but parallel form of the posttest. The criterion test consisted of three subtests, two of which required the subject to predict pattern changes and the last one to produce a given pattern. It should be noted that for groups receiving the instructions, these tasks would be of the rule learning type and the problem-solving type, respectively, while for the other groups, all three tasks would be of the problem-solving type (Gagne, 1970). An attitudinal instrument was also administered to the subjects. Results indicated that the groups with objectives, while not performing better on the prediction subtests, performed significantly worse than the groups without objectives on the pattern production subtest. The groups receiving the instructions, on the other hand, performed better than those without instructions on the prediction subtests and those not

on the pattern production subtest. It was concluded that, in the situation described, objectives had either a neutral or an interfering effect on learning.

Stedman (1970) investigated the effects of behavioral objectives across levels of knowledge, comprehension, application, and analysis. His 144 high school students, blocked on IQ and motivation, studied a 93-frame programmed unit on genetics. Four treatment groups had been created; one group with no objectives, one group with general objectives, and two groups with behavioral objectives inserted into their programs. The 28-item posttest comprised seven items in each of the categories of knowledge, comprehension, application and analysis. Performance was not significantly influenced by the presence or type of objectives included in the study, nor were there interactions with type of learning.

The effects of disclosure of cognitive and affective educational objectives on learning were investigated by Brown (1970). The topic employed as subject-matter was politics and was taught through a series of role-playing games. Seven criterion variables were employed to assess outcomes, three of them pertaining to cognitive outcomes, and four to affective outcomes. The three cognitive outcomes were (a) knowledge of facts and principles, (b) problem-solving in situations similar to those presented in the games, and (c) problem-solving in novel situations. In no case was a significant treatment effect found. However, performance on the cognitive outcomes was extremely low and little over chance expectation for outcomes 2 and 3. A secondary hypothesis predicting an interaction with race and sex was confirmed in only two of the seven criterion variables.

In summary, then, type of learning has been investigated in seven studies but only one study (Papay) found objectives to be more effective with one type of learning (knowledge) than others. This difference furthermore was apparent only on the posttest and not on the retention test. While Yelon and Schmidt found either a neutral or interfering effect for objectives with a problem-solving task, their results, if they are to be generalized, need replication in a school setting The other studies reviewed found no other significant differences with respect to type of learning, although learning was categorized in a number of different ways.

Learner Characteristics

This group of studies has attempted to discover interactions between the availability of objectives and certain learner characteristics, usually student ability defined in various ways . There are eight studies in this category.

Cook (1969) investigated the effect of informing students of behavioral objectives and also their place in the hierachical learning sequence. A group of 88 elementary education majors was administered a set of 10 self-instructional mathematics booklets during a period of 8 consecutive class days. A first group of students received only the booklets. A second group received a list of behavioral objectives at the beginning of each unit. A third group received an outline of the learning hierarchy and a fourth group received both objectives and hierarchy. For data analysis, students were further blocked by ability level which was based on their grade in a mathematics course during the previous semester. Performance tests administered immediately after t[redacted] instructional units failed to show significant differences between the groups. However,

a retention test administered two weeks later indicated that the second group (provided with specific objectives) had a significantly lower rate of forgetting than did the three other groups. Rate of forgetting was measured as the difference between the posttest and retention test. A further analysis of overall performance revealed that an interaction between treatment and ability level was present. It indicated that providing students with objectives and the learning hierarchy was most profitable for the middle ability students.

Conlon (1970) investigated the effects of behavioral objectives in an individualized science program. The first eight self-instructional units from the ISCS program were used. This program consists of highly sequenced, predetermined instructional materials. Students participating in the study were seventh-graders in the classes taught by four teachers. Two of the classes were provided with instructional materials and the objectives of instruction, the other two with only the instructional materials. The students were also blocked into three ability groups as determined by their scores on the California Test of Mental Maturity. Two sets of dependent measures were collected: scores on the self-tests accompanying each unit, and scores on a final achievement test. Results on either of these measures indicated no significant differences between the groups, nor any interaction effects of ability level with knowledge of behavioral objectives. The author concluded that knowledge of behavioral objectives may be advantageous only as guides to independent study or instructional sequences that are not highly structured.

Nelson (1970) studied the use of behavioral objectives with college students of different scholastic ability. The 117 freshmen students enrolled in a course dealing with principles of microeconomics were blocked (high, medium, and low) on the College Aptitude Rating test. Students in

the experimental group received one to three pages of specific instructional objectives each week of the course. The subject matter was taught by the traditional lecture method. Two testing instruments were administered both on a pre and post treatment basis. These were (a) the Psychological Corporation's Standardized Test of Understanding in College Economics, Part II; and (b) The University of Minnesota's Department of Economics Test. On both tests, the behavioral objectives group was superior to the control group. The objectives, however, did not differentially benefit students with varying scholastic aptitudes.

Kueter (1970) investigated the interaction of student personality factors with recognition learning, using behavioral objectives as opposed to no objectives. His subjects were sixth, seventh, and eighth grade students which viewed a 10-minute color film on "The Monarch Butterfly." The High School Personality Inventory was used to block the students on 14 personality traits according to degree (low, medium, or high). Within these levels, subjects were then randomly assigned to treatments: (a) given statements of behavioral objectives, or (b) not given such statements. A recognition test was administered immediately after the presentation and an identical test administered one week later. The behavioral objectives groups showed superior achievement on both occasions. It was also found, however, that objectives were less effective for students with personality traits of submissiveness, self-control, considerateness, conscientiousness, or low ergic tension.

Etter (1969) concentrated on individual differences of adult learners as they relate to achievement with prior knowledge of instructional objectives. His subjects were 40 male and 40 female part-time learners from various adult education programs who volunteered for the study.

The learner characteristics included in the study were: (a) Age, (b) Sex, (c) Socioeconomic status (SES), (d) A measure of Learner Outcome Preference (LOP), (e) Verbal Ability, and (f) Life goals. The instructional task was a 135-frame programmed learning text on the subject of the stock market. One group of subjects received specific objectives; a second group received general objectives and a third group no objectives. No main effect was found for objectives, and only socioeconomic status, analyzed within sex, was found to interact with objectives: high SES males learning with specific objectives scored significantly higher than others with specific objectives.

Merrill (1970), in a CAI study investigating the interaction of cognitive abilities with the availability of rules and/or behavioral objectives, did not choose differences in task performance as a dependent measure of the effects of behavioral objectives. Rather, his college level subjects, learning through examples the imaginary science of Xenograde Systems, were required to reach a minimum criterion performance at each level of the task before proceeding to the next level. Dependent measures were the number of examples required by the student, the amount of time required to learn the task (display latency), and performance on a transfer performance test. The subjects were assigned to an Example-Only group, an Objective-Example group, a Rule-Example group, and an Objective-Rule-Example group. Before learning the task, the subjects were given a battery of six cognitive ability tests which were later used for an analysis of interaction effects. A significant rule effect was found in favor of the rule groups, with rules reducing the number of examples and total latency and increasing transfer test performance. Objectives significantly reduced the number of examples required to learn the task. However, they also increased or had no effect on display latency but significantly

reduced test-item-response latency. An analysis of the cognitive measures showed that, while reasoning had a high negative relationship to test-item response latency for subjects in the Example-Only group, this relationship was significantly smaller in the remaining groups. Therefore, the presentation of objectives and/or rules seem to have effected a reduction in the requirement for reasoning ability.

In a similar experiment, Merrill and Tow'e (1971a) examined the effects of behavioral objectives and/or test items on the learning process. The same Xenograde materials were used and presented in CAI mode. In this study, however, the subjects were allowed to receive only one example and were therefore not required to reach criterion before going to the next module of instruction. The 123 college students participating were assigned to either an Example-Only group, an Objective-Example group, a Test-Example group, or an Objective-Test-Example group. Along with an example or an example and an objective, the last two treatments consisted of a criterion-referenced test item to which the subject responded. No feedback, however, was provided. Dependent measures included the following: display latency, i.e., the time the subject spent studying the examples; and, depending on his treatment group, the corresponding objective; intratask test item response latency for the test groups; and a criterion-referenced posttest. Four cognitive ability tests and an anxiety scale were also administered to the subjects. A significant objective effect on display latency revealed that subjects who received objectives spent more time studying the examples and corresponding objectives than those subjects who received no objectives. However, a significant reasoning ability by treatment interaction revealed that reasoning ability had a negative relationship to display latency for the groups which were given test

items, but not for the others. Unlike the previous study, no differences were found on test-item-response latencies. Also, no significant differences were found on the posttest. Therefore, the presentation of objectives and/or test items did not increase terminal criterion performance.

Merrill and Towle (1971b) investigated the effects of providing behavioral objectives in a graduate course on programmed instruction. Their 32 subjects took six units of instruction either with or without behavioral objectives. In addition to looking at performance on unit tests, the investigators also looked at test-item response latencies, study time as recorded by the students, and state anxiety after each unit test. The only significant difference found was with the latter factor. The availability of objectives decreased the reported level of state anxiety. However, this reduction was significant for the first three units only, the effect diminishing as the students progressed through the course.

In summary, behavioral objectives have been found to interact with a number of learner characteristics. With respect to aptitude, conflicting evidence has been reported. When blocked on grades from a course in the same area, middle ability students profited more from objectives but only when these were accompanied by a handout illustrating the learning hierarchy; however, no interaction existed between aptitude and objectives alone or the hierarchy alone. When blocked on a standardized test of ability, no interactions were found in either of two studies. However, an interaction was found with reasoning ability in one study, pointing to the conclusion that objectives may reduce the requirement for reasoning. With respect to personality, students with certain

characteristics were found to profit less than others from specific objectives. With respect to state anxiety, no interaction was found in one short term study, but objectives were found to effect a reduction in state anxiety in a second, long-term study.

Time to Criterion

The three studies included in this final category have investigated the hypothesis that students provided with objectives will take less time to learn the material than students without objectives. Their main dependent measure was learning time.

In a study by Mager and McCann (reported by Mager & Clark, 1963), newly graduated engineers participating in a specialized six months engineering course were given 24 pages of detailed course objectives and full learner control of the instruction. All classes were cancelled and the students were told that they would have complete control over what they learned, when they learned it, and from whom they learned it. They could ask for instruction from any instructor but were told not to accept instruction they did not want. As a result, they completed the six months course in approximately 7 weeks, thus reducing training time by 65%. They also appeared to be as well, if not better, equipped than the graduates of the traditional program.

In a study by Allen and McDonald (reported by Mager & Clark, 1963) subjects were required to learn the pieces, rules, and strategies of a new game. One group utilized a linear programmed text, while the subjects in a second group were each provided with a list of objectives and an instructor that they could turn on and off at will. The members of this second group mastered the game nearly as well as did the program group but took only half of the instruction time it required. It should be noted,

however, that the last two studies reviewed are heavily confounded by the student control variable, thus making interpretations with regard to objectives only very tentative

The relationship between the availability of behavioral objectives and time was also investigated in a more controlled situation by Smith (1970). His experimental group was informed of both the hierarchical structure of the topic and the behavioral objectives associated with each step. The 73 college students then undertook a 6-week period of independent study concerning finite set theory. The experimental subjects, given periodical questions to assess their awareness of the objectives, did show such an awareness. However, no significant differences were obtained with respect to the time required to complete the learning sequence.

In summary, the provision of learner control along with objectives would seem to greatly reduce learning time when compared to a no learner control condition. However, when only objectives distinguish between treatments, as in Smith's (1970) independent study situation, they do not seem to reduce learning time. The results reported by Dalis (1970) and Merrill and Towle (1971b) further point to this conclusion. Other studies mentioned earlier, (Merrill, 1970; Merrill & Towle, 1971a), have also looked at time factors, although in a learning situation much more structured and short in duration Their findings indicate that subjects provided with objectives spend more total study time on the learning task. If we consider the time involved in reading the objectives as negligible, objectives would then seem to increase the amount of attention paid to the materials themselves.

General Summary

The studies reviewed above, however incongruent their results may be, do point to a certain facilitative effect derived from the availability of specific objectives. How great and how generalizable this effect may be remains to be determined.

Results obtained from the research which simply addressed the general issue are, to say the least, inconsistent. Studies which have found no significant differences between experimental and control groups are as numerous as those which have found such a difference. Furthermore, when we consider the total number of studies which have investigated effects on student achievement, an even smaller proportion of studies have found a significant main effect for this variable. However, those studies which have found such an effect have usually favored the presentation of objectives (the one exception is the Yelon and Schmidt study). A further difficulty in interpretation arises in those studies which have found different results between immediate learning and retention.

Furthermore, within this overall picture, we have looked at three factors which could have perhaps accounted for the discrepancies. The first of these is the topic or subject matter used in the learning materials. Topics ranged from the physical sciences to the social sciences, but this factor did not seem to bring any more consistency to the results. The second factor we looked at was level of schooling. Here again, it did not seem to matter whether the study was conducted with primary, secondary, college, or adult learners. Neither did the time factor seem to bring any more clarity to the results: positive findings were found with a 10-minute instructional period just as with instruction

ranging over many weeks. It is difficult to say at this time whether any other characteristics may be at play and could possibly clarify the situation.

Type of learning, a variable which has been investigated in a number of studies, seems to contribute little to an explanation of the phenomenon. Also, the investigation of learning time as a factor has resulted in ambiguous findings. On the other hand, a number of individual differences have been found to interact with objectives, pointing to the need to restrict any generalizations.

Discussion

Decision-Oriented Aspects

What does the present review bring to the decision-making process which administrators, teachers, and educators at all levels must face with respect to the value of providing their students with behavioral objectives? The issue is really a secondary one. Since educators, if they go to the trouble of specifying behavioral objectives, will most likely make them available to their students. However, we believe that many educators would wish to generalize the situation to the more general issue, i.e., to the overall value of objectives in instruction. Had the evidence been different and pointed to a clear-cut superiority for behavioral objectives, we believe advocates of behavioral objectives would have used this evidence to support their argument that educators should specify their objectives in behavioral terms. But let us return to the issue: does, in fact, providing students with behavioral objectives have a facilitative effect on their learning? The evidence reported here demonstrates the complexity of the issue and the many seemingly contradictory results obtained by various researchers points to the

wide array of variables involved. It is, therefore, very difficult to derive at this time any practical conclusions, either general or specific, with regard to the presentation of objectives to students.

As previously pointed out, we believe the functions of behavioral objectives are not always clearly differentiated in discussions of the concept. It is extremely important, therefore, to keep very clearly in mind that the only issue addressed in this review was that of providing students with objectives. It would be indeed unfortunate if this review were used in one way or another through overgeneralization to influence or advocate a position with respect to the value of behavioral objectives in their other (and perhaps primary) functions: direction for teaching and guidance in evaluation.

Conclusion-Oriented Aspects

Since the main effects reported in this review have yielded no consistent overall answer to the more practical and educationally relevant aspects of the issue, we are forced to turn back to a more basic line of research and investigate the possible interactions of the variable with concomitant variables. This line of research can be labeled as conclusion-oriented (cf. Cronbach & Suppes, 1969) in that it is directed more toward theory development than toward immediately relevant instructional answers. From the evidence reported, we see the need to investigate the effects of behavioral objectives not in any general manner, but rather as they interact with both content characteristics and individual student differences. Already we have seen that objectives can interact with learner characteristics and that this line of research should be pursued. With respect to type of learning, results have not been very promising. However, it is very possible that objectives could interact with other learning material characteristics, such as structure, familiarity, sequence, etc.

As an instructional variable, behavioral objectives would seem to fit into the class of variables termed orienting stimuli (Rothkopf, 1970; Frase, 1970). In this sense, they refer to stimuli which activate inspection behaviors on the part of the student, which in turn determine what is learned. As orienting stimuli, they are analogous to questions (Frase, 1970) and advance organizers (Ausubel, 1968). Generally, the research on the effects of questions on learning from text has resulted in findings of interactions with position of questions, contiguity of questions and content, type of questions, individual differences in motivation, and text characteristics (see Frase, 1970, for a review of this research). The research with advance organizers is very similar to that of specific objectives in that main effects have often been inconsistent and the effort has been turning to an analysis of interactions (for example, Ausubel & Fitzgerald, 1962; Dawson, 1965; Allen, 1969).

Conclusion

In concluding this review, it would seem profitable to briefly reconsider various rationales which predict a facilitative effect of behavioral objectives on learning, and, where possible, to suggest how these hypotheses may be operationalized in experimental research.

One function of presenting behavioral objectives to students may be to provide direction to their learning. By determining exactly what is expected of them, objectives would assist them in discriminating between relevant and incidental or illustrative content. Hypotheses of this nature have been investigated by Rothkopf and his colleagues (Rothkopf, 1970) with respect to questions, and may be directly extended to behavioral objectives.

A second function of objectives may lie in the fact that objectives could provide some organization to the subject matter, much the same as is done by preceding materials with an advance organizer. In this sense, objectives would facilitate the student's integration of diverse units of information by providing a general structure to the content. This hypothesis, it seems, could be investigated by analyzing the effects of objectives within sets of learning materials which are characterized by different degrees of structure, such as randomly versus logically sequenced programmed instructional materials.

A number of other possible functions of providing objectives to students may be hypothesized, although operationalizing these hypotheses may be somewhat more difficult The first of these is that objectives may serve a management function by enabling the student to better organize his time and learning experiences in accordance with the goals of his courses. Such self-management may help the student avoid procrastination and the resulting cramming sessions which often precede final examinations. A related function of objectives may be that of providing feedback to the learner with respect to his fulfilling the learning task. Thus, a list of objectives would enable the student to repeatedly compare his performance to the criteria involved in the objectives, and thereby effectively deal with any resulting discrepancies. Finally, a further function of objectives may be to activate and maintain a certain kind of task reinforcement. For example, the student who knows he is mastering a set of objectives as he progresses through the learning task will probably be more effective than the student whose only reinforcement comes with a grade at the end of instruction.

While these last three substantive hypotheses may be difficult to actually deal with, the first two hypotheses would seem to be more amenable to investigation in a research context. However, certain practical difficulties, which may have caused some of the studies reviewed in this paper to result in non-significant findings, should be avoided. The most evident of these relates to the use which the students make of the objectives. Indeed, objectives will certainly make no difference if the student pays no attention to them in the learning situation. A few investigators have attributed their non-significant results to this factor. In Tiemann's study (1968) for example, in which objectives had no effect on the mid-term exam but did have an effect on the final exam, it was reported that student questions pertaining to the objectives were very few before the mid-term test, but much more frequent afterwards. Presumably, then, the mid-term exam, which was directly referenced to the objectives, led the students to grasp the importance of the objectives and concentrate their efforts on them. In future research, therefore, it should be made certain that students understand the meaning of objectives and actually use them while learning. Perhaps more than a short introduction to objectives may be required to accomplish this.

A second difficulty involved in research on objectives lies in the nature of the objectives themselves. A set of behavioral objectives has many dimensions which should be taken into account in designing research and reporting results. Of special importance is the dimension of specificity which may not necessarily concord with the dimension which categorizes objectives as behavioral or non-behavioral. A further dimension is the number of objectives provided to the student. Situations may well arise

in which a list of objectives is so extensive and detailed that the student is actually overwhelmed and confused by the objectives. Such a list of objectives would naturally defeat its own purpose.

The dimensions which underly objectives are difficult to identify with any precision, as is well evidenced by the variety of objectives employed in the different studies reviewed in this paper. Future research, if it is to lead to valid and generalizable conclusions, should seek to clarify these dimensions.

As a final note, we recommend the extension of the present line of research which involves the investigation of interactions between the availability of objectives and both task characteristics and individual differences. It seems that this approach will lead to the most fruitful results.

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